US Army Corps of Engineers
Huntsville Division

SITE ADAPTION HANDBOOK

AMMUNITION SURVEILLANCE FACILITIES

STANDARD DESIGNS
6 BAY FACILITY STD 216-12-01
12 BAY FACILITY STD 216-12-02

AUGUST 1983

SITE ADAPTION HANDBOOK

AMMUNITION SURVEILLANCE FACILITIES

STANDARD DESIGNS

6-BAY FACILITY STD 216-12-01
12-BAY FACILITY STD 216-12-02

PREPARED BY

THE U. S. ARMY CORPS OF ENGINEERS
HUNTSVILLE DIVISION
HUNTSVILLE, AL

TABLE OF CONTENTS

FIGURES

APPENDICES

I. INTRODUCTION

A. Background

The purpose of the Ammunition Surveillance Program is to determine serviceability of all ammunition and explosives in the Army inventory and of those items of other services stored at Army installations. The ammunition surveillance facility includes inspection bays, test cubicles, storage cubicles, support areas and storage areas to accommodate examination of conventional munitions, missiles and ammunition materials during current and future quality assurance operations.

Existing facilities being used for this function were not designed for surveillance inspections and are outdated and unsafe for this purpose. Accordingly, the US Army Defense Ammunition Center and School (USADACS) at Savanna, Illinois, along with the involved installations and US Army Development and Readiness Command (DARCOM) has identified the need and functional requirements for these new facilities. The US Army Engineer Division, Huntsville (USAEDH) supported USADACS in this effort. Upon final approval of the functional requirements, the need to standardize these designs was identified to HQUSACE. In October 1982, HQUSACE issued a design directive to USAEDH to develop the standard designs for 6-bay and a 12-bay facilities. In July 1983, USAEDH delivered the completed 6-bay and 12-bay standard designs to HQUSACE.

B. Purpose

This handbook provides information and guidance for site adapting the Ammunition Surveillance Facilities, 6-bay and 12-bay standard designs, prepared by USAEDH, Huntsville, AL. The main objective is to highlight the

features of the design which will require further engineering efforts due to interfaces with site specific requirements (siting, site electrical power, commercial water supply, waste disposal, geotechnical conditions and HVAC) and services five feet or more outside of the building (i.e., security fencing, lightning and surge protection, grounding counterpoise interfaces, communication system interfaces, etc.).

C. Brief Description of the Facility: The Ammunition Surveillance Facility is a single story non-combustible structure. The facility houses inspection bays, test cubicles, storage cubicles and support functions. The exterior walls are constructed of prefinished insulated metal sandwich panels at the support area. The roof construction is prefinished insulated metal sandwich panels with standing seams and concealed fasteners for the inspection bays and precast concrete panels with metal panel covering at the support area. Dividing walls between inspection bays and storage cubicles are designed as per TM5-1300 to provide Category 3 blast protection due to a 425 pound charge weight in an adjacent bay or cubicle. In case of an accidental explosion in one of the inspection bays, the metal panel roof and sidewalls are sufficiently frangible to provide adequate venting of the blast pressure. Roof framing in the inspection bays is composed of steel joists spanning the dividing walls. Storage cubicles are designed to be constructed to provide security protection equivalent to the structural standards of DOD 5100.76M for Category II material. The bay support area end walls (separating the inspection bays from the support area), roof, and perimeter walls are designed to provide TM 5-1300 Category 1 protection (personnel protection).

See Appendix A, Design Analysis, for more narrative details and discussion of the design assumptions and philosophy.

II. SITING CONSIDERATIONS

A. General. The site should be centrally located and as near as possible to the sources of ammunition (storage magazines, production lines, etc.) to be inspected at the facility should be well-drained, not located in a floodplain, and very gently sloping (to facilitate railroad construction). Site should be located as near as possible to existing roads and railroads to reduce the length of new roads and railroads needed to serve the facility. The pavement design for roads and parking areas will vary from site to site and will depend on factors such as soil type, expected vehicle types to use pavement, and the traffic volume.

B. Required Land. The size of the site will depend upon the amount of parking area desired, configuration of roads and railroads serving the facility, slope of the terrain, and size ofthe facility (i.e. 6-bay and 12-bay). The land required for the facility only is about 0.5 acres for the 6-bay facility and about 0.9 acres for the 12-bay facility. Additional land may be required during construction for stockpiling topsoil and for storing construction equipment and materials

C. Security Fencing. If the installation the facility is located on has existing security fencing, then fencing around the facility may not be needed. If facility fencing is needed, the facility should be surrounded by a type FE-5 chain-link fence (6' minimum height) with as few gates as possible to meet potential requirements of paragraph 4-3, AR 150-11 for protection of REDEYE and STINGER Missiles or operational procedures must provide for

surveillance by an armed guard. Vehicle parking area should be located outside the fence. Drainage culverts and ditches passing under the fence should be barred with approved grills to prevent unauthorized entry. A clear zone should be maintained 12 feet outside the fence and 30 feet inside the fence. This clear zone should be free of all obstacles, topographic features, and vegetation exceeding 8" in height (see AR 190-11 and DOD 5100.76M for more information).

D. Rail Service. The slope of the site should be such that any new track built into the site will have less than 0.5% slope. Number 8 turnouts should be used and all curves should be less than 12° to allow passage of all rail cars now in use. Tracks should be bonded and grounded for distance of 100 feet either side of any structure including loading docks where explosives, ammunition, or explosive mixtures are stored, handled, or processed. Track should also be bonded and grounded at turnouts and at overhead power line crossings where voltages exceed 600 Volts (for more information see DARCOM Reg 385-100).

E. Safety Requirements. Underground fuel tanks should be at least 10 feet away from the facility with the fill spout being at least 50 feet away from the facility. A spill-containment curb is not required around the fill spout, but the site adaption engineer may want to add this feature for safety sake. Quantity safety distances from the facility to the most often occurring activities are summarized by Figure 1 (for more information see DARCOM Reg 385.100).

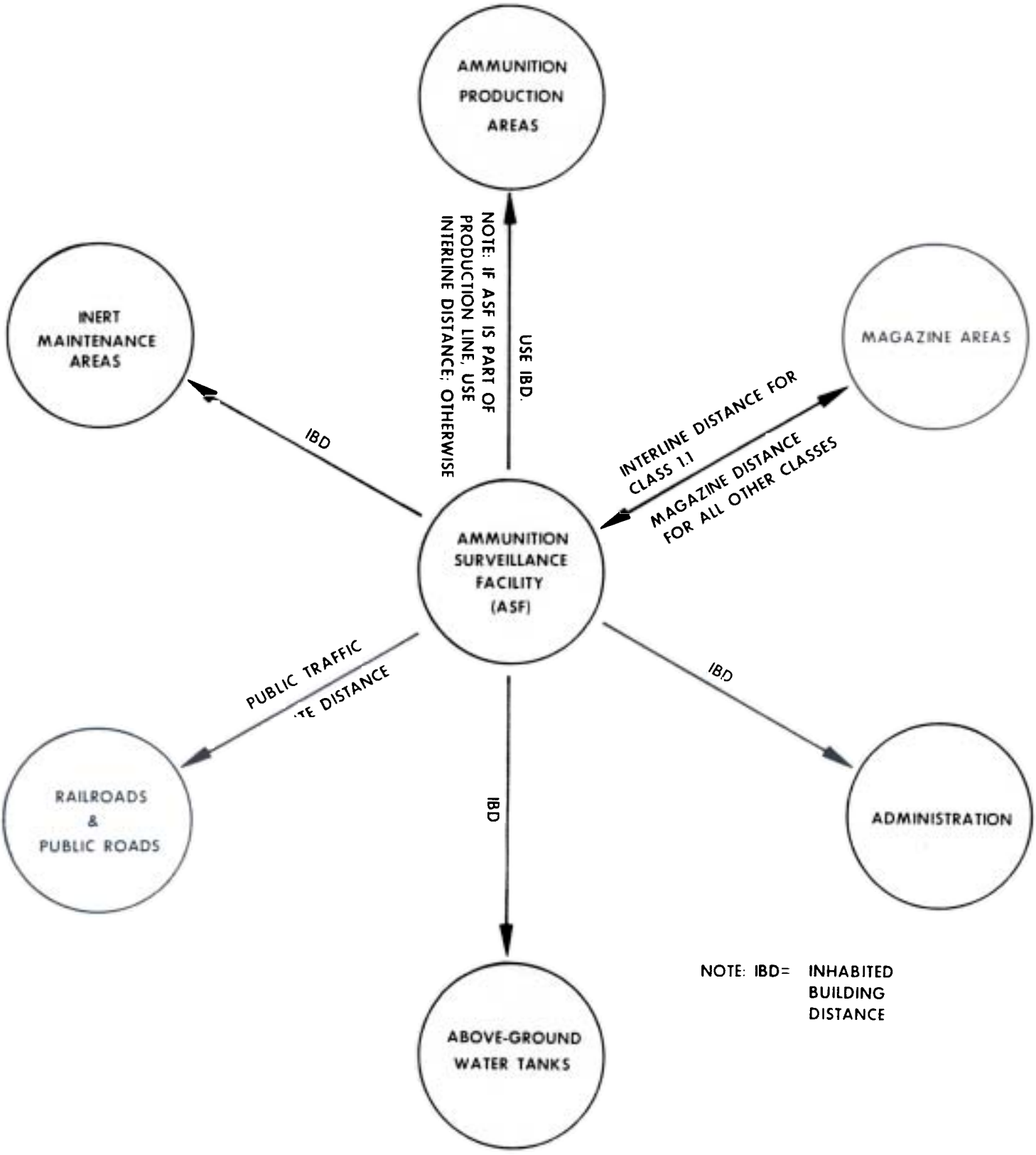


FIGURE 1. AMMUNITION SURVEILLANCE FACILITIES
QUANTITY SAFETY DISTANCE BUBBLE DIAGRAM

III. ARCHITECTURAL

A. Insulation: Building U-values for the specific site must be identified and compared with the U-value established in Section 7A (Protected Metal Roofing and Siding) of the Standard Design Specifications and must be identified for the insulation to be installed with the precast concrete panels required by Section 6A (Rough Carpentry). Values may vary depending upon the georgraphic area in which the facility is to be constructed. If site specific U-values are different than those specified in Section 7A, then the specification must be changed. U-values must be inserted in the specifications for insulation at the precast concrete panels, Section 6A.

B. Gutters/Downspouts: Sizes of gutters and downspouts must be verified for the geographic area in which the facility is to be constructed.

C. Bay Support Area Room Sizes: Room sizes in the Bay Support Area may be varied depending upon the individual installation's needs. Partitions around these areas are not load bearing and can be relocated to meet the user's requirements.

IV. STRUCTURAL:

A. Foundation

a. The standard designs provide for a finished floor elevation at grade. If the building is to be elevated to dock height, the perimeter walls must be designed to resist at-rest earth pressures.

b. Normally acceptable soil types and compaction efforts will be suitable for this facility. Two items which should be addressed in the foundation investigation are expansive soils and sulfate attack. The floor slabs and foundations are not designed for expansive soils, and if these are present, a reevaluation of the design will be necessary. Similarly, if the soil at the proposed site contains high concentrations of sulfates, appropriate protective measures must be taken to avoid concrete deterioration. The plans and specifications should be changed to reflect this.

c. The following classification of various soils and their repsective properties are the limits used to size the cantilever blast wall base slab foundation (reference Technical Report 4921 "Overturning and Sliding Analysis of Reinforced Concrete Protective Structures," February 1976). A redesign of the cantilever blast wall base slab foundation would be required if the limits are exceeded upon foundation investigation.

SOIL PROPERTIES

(1) Sands and Non-plastic Silts

Angle of Internal Friction	Friction Factor f_c	Modulus of Elasticity E (psi)	Poisson's Ratio u
	0.58	3000	0.275
	0.675	5500	0.25

(2) Clays, Sandy-Clay Mixtures, Plastic Silts

Adhesion c (psf)	Modulus of Elasticity E (psi)	Poisson's Ratio u
750	3500	0.45
1500	5500	0.45

d. The depth of foundation shown is minimum and shall be adjusted as required below the depth of frost penetration at specific site. Foundations, as designed, must be placed upon undisturbed soil.

B. Support Area

a. The support area is designed to provide Category 1 protection (reference TM 5-1300) from a blast wave due to an incident in the adjacent inspection bay with a quantity of 425 pounds of explosives.

b. Cast-in-place concrete wall and roof may be substituted for pre-panels provided a design analysis is done as per TM 5-1300.

c. The W18 x 40 beams are designed to withstand blast overpressure for a minimum length of 16'-6" and a maximum of 24'-0". If the beam limits are exceeded due to floor area requirements, a redesign of the beams is required.

C. Inspection Bays

a. The inspection bays have been modularized to a standard size so can be added or deleted as required.

b. The test cubicles have been designed to provide Category 1 protection (reference T15-1300) from an incident based on 15 pounds of explosives within the cubicle.

c. The test cubicles may be deleted as required.

d. The high bay area is designed to accept a top running 5-ton bridge crane which is to be supplied by the user. If an individual installation requires loading/unloading of large items which cannot be brought into the high bay through the load/unload area they must be brought into the inspection bay from the side. Figures 2 through 5 are supplemental layouts showing a 5-ton jib crane and a roll-up configuration door to handle such items.

V. WATER SUPPLY, SEWAGE DISPOSAL AND ENVIRONMENTAL REQUIREMENTS

A. Water.

1. Domestic water requirement is determined at 50 gallons per person per 8-hour shift.

2. Water requirement for fire protection is based on the classification of occupancy. Ammunition Surveillance Facilities are classified as extra hazard occupancies. Water requirement is estimated at 0.35 gpm/sq. ft. Hose stream demand is estimated at 500 gpm and 60 min.

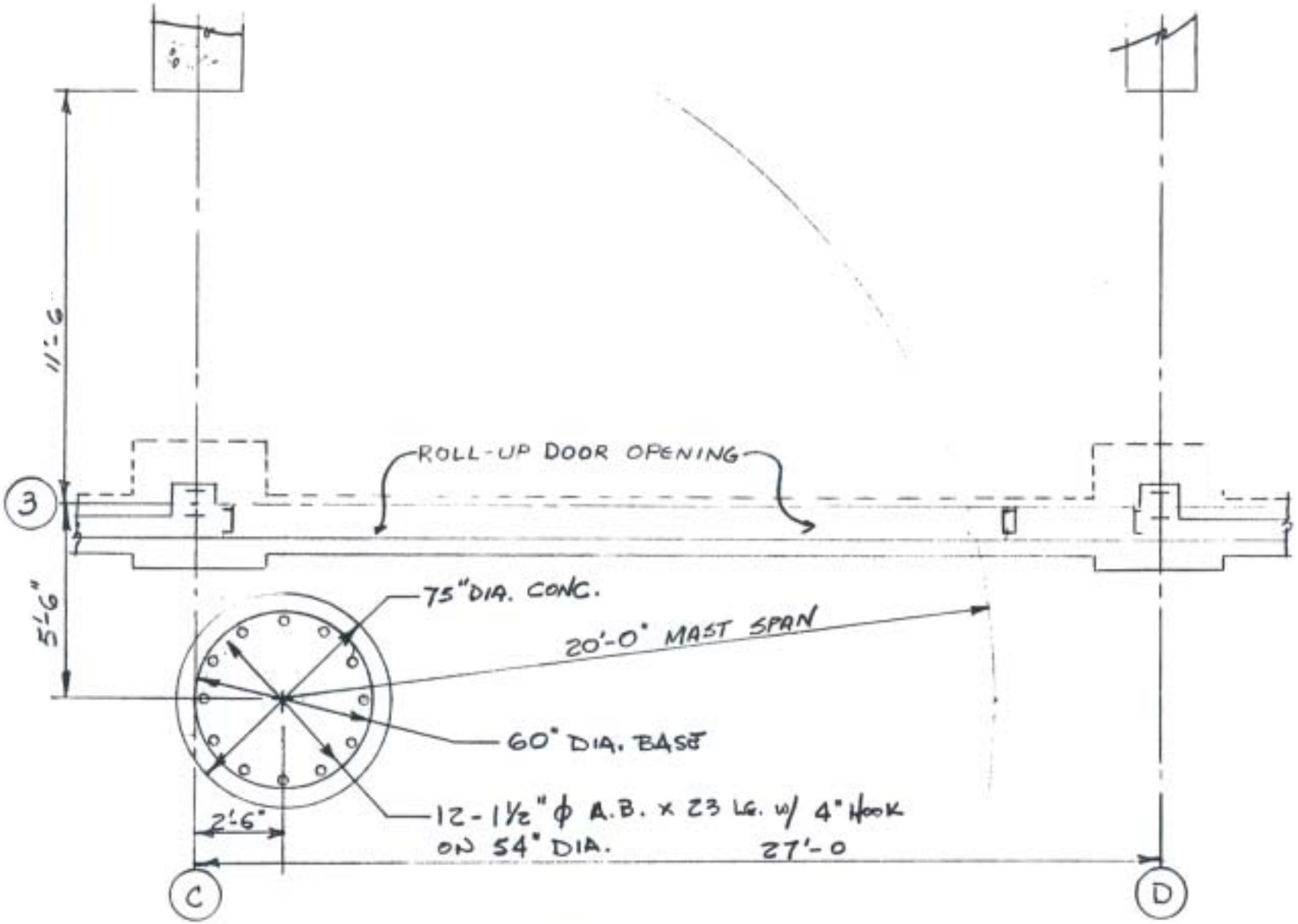
B. Sewage Disposal - Sewage disposal can be accomplished by either on-site disposal or treated at the existing sewage treatement plant. The quantity of the flow is estimated at 30 gallons per capita per 8-hour shift.

C. Environmental Requirements.

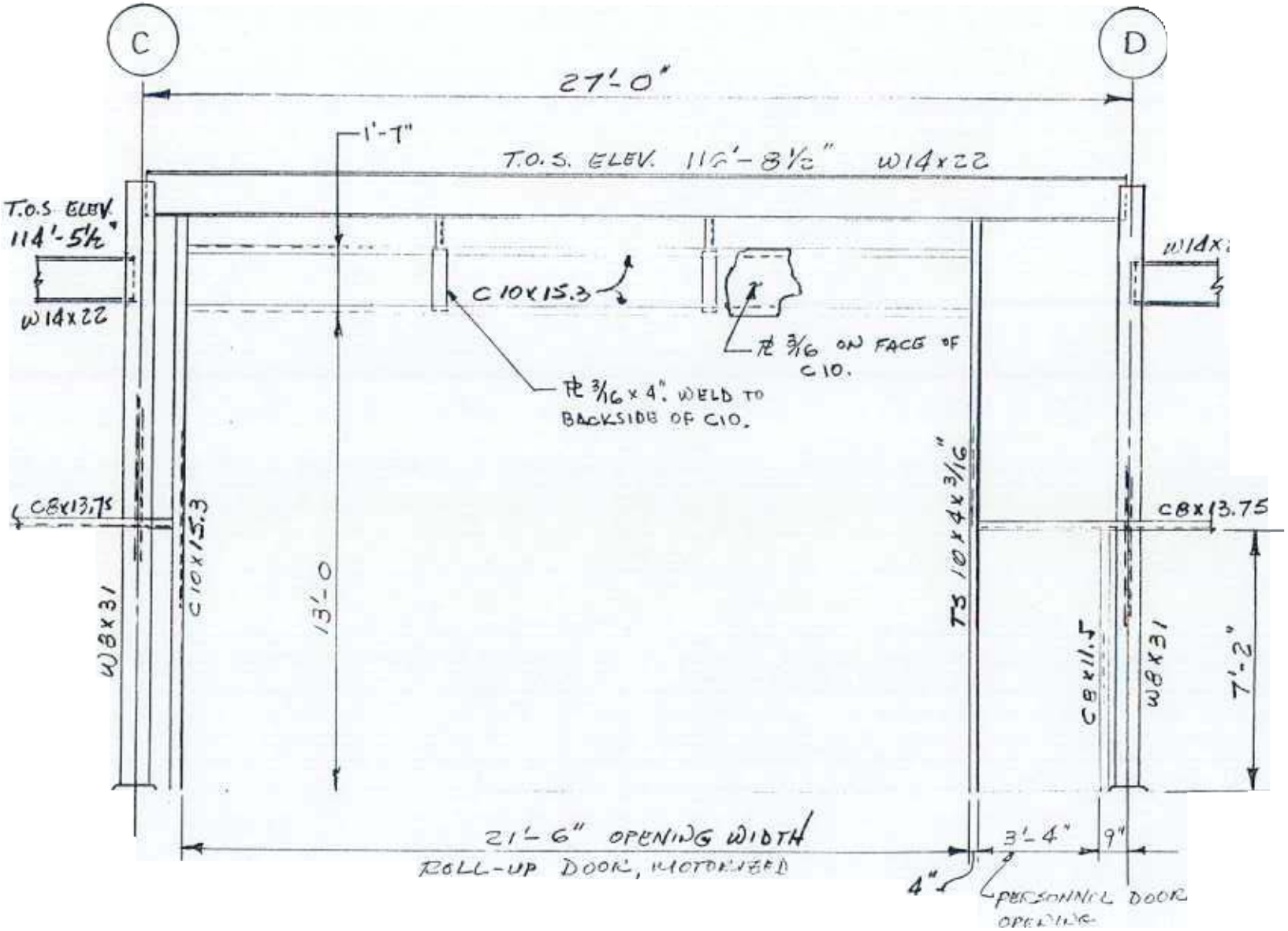
1. Fuel storage tank should be surrounded by the berm for containment. The requirement is specified in each installation's spill contingency plan.

2. Contaminated water from wash down should be collected by the underdrain and stored in the sump. The waste should be removed periodically and disposed in an environmentally sound manner.

D. Cathodic Protection - Provide cathodic protection for all underground utility lines if required by the site specific conditions.

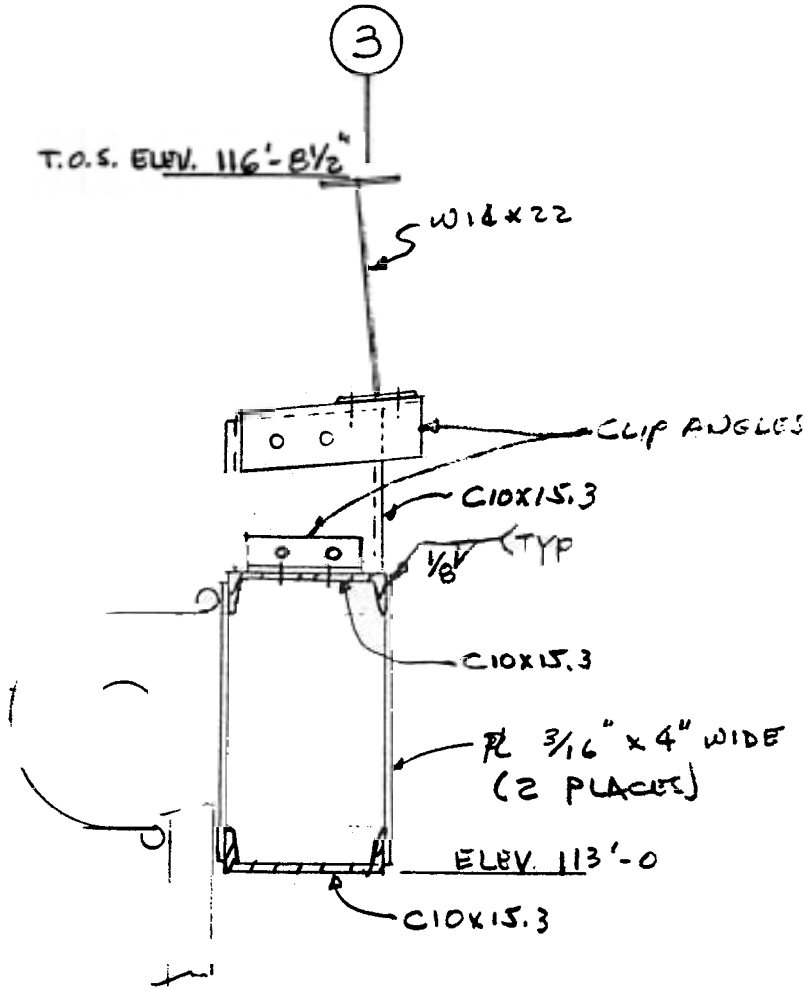


PARTIAL PLAN
JIB CRANE
FIG. 2



PARTIAL ELEVATION (ROLL-UP DOOR FRAMING)

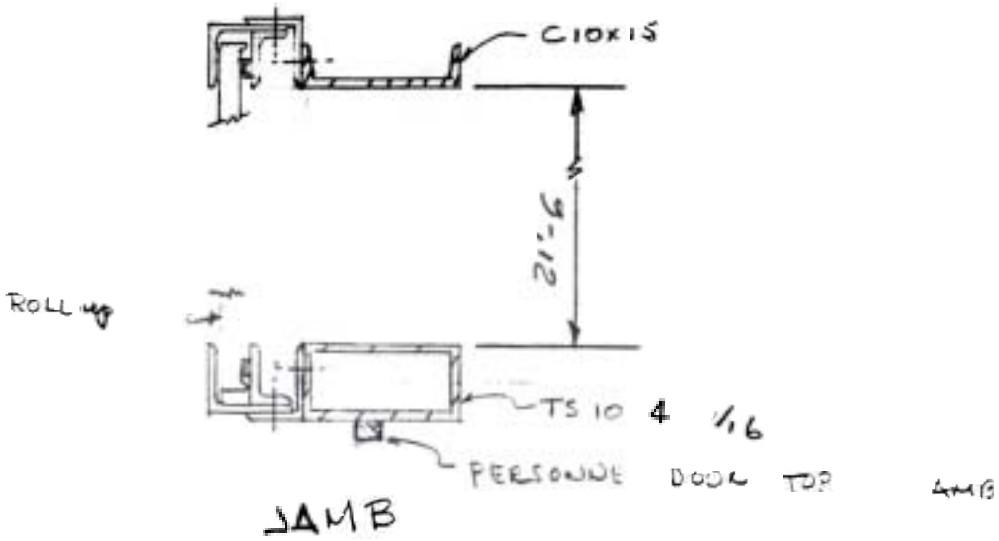
FIG 3



HEAD

ROLL-UP DOOR

FIG. 4



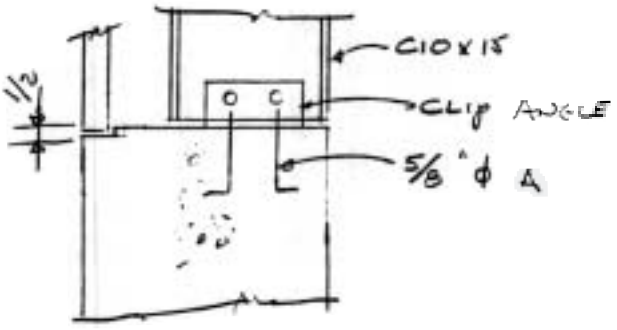


FIG 5
ROLL UP DOOR JAMB SILL DETAILS

VI. MECHANICAL

A. HEATING.

1. Site Specific Design Conditions

a. The indoor design temperature for the Ammunition Surveillance Facility shall be in accordance with DOD 4270.1 and AR 11-27 and are as follows:

Bay Support Office - 65° FDB

Bay Support Break Room - 65° FDB

Bay Support Tool Room - 65° FDB

Inspection Bays - 55° FDB

Supply Room - 55° FDB

Mechanical Equipment Room - 50° FDB

No adjustments will be made to the indoor design temperatures at site adaption.

b. Outdoor design temperatures shall be based on the 97½% dry bulb design data taken from the current edition of the Joint Service Mnnual, TM 5-785, Engineering Weather Data. An outdoor design temperature of 0° FDB was assumed in designing the hot water heating system for the standard design. If the outdoor design temperature at the selected site is significantly different from the assumed 0° FDB, then the site adaption designer must recalculate heating loads and reselect the most efficient heating system equipment for the calculated load. Heat transmission factors for walls and roof shall be in accordance with DOD 4270.1 M. Heat loss shall be calculated in accordance with the methods specified in the ASHRAE Guide.

2. Site Specific Configuration Changes

If it is decided to use a facility configuration other than that shown in the Standard 6 or 12 Bay Design, then the designer must recalculate the heat loss load and reselect the heating equipment. All equipment selected shall meet the requirements of the specifications for standard design. Note any changes in pipe sizes for any piping system penetrating the blast wall separating the inspection bays and bay support area must be coordinated with the penetration details shown on the structural drawings. Once the heat loss for the facility has been established, the boiler selection can be made. An evaluation of the most economical boiler fuel shall be made based on price and availability. The fuel storage tank shall be sized for a 30 day supply and located in accordance with DARCOM 8 385-100. See Section II, Siting Considerations for more details on fuel storage tank location. When the tank location is determined the vertical lift from the bottom of the tank to the burner suction inlet at the boiler oil pump shall be verified. If the fuel storage tank must be located a great distance from the boiler it may be necessary for the designer to add a transfer pump and day tank to the fuel system.

3. Central System VS. Packaged Heating System

At some sites it may be possible to tie into an existing heat distribution system rather than providing a separate packaged heating system for this particular facility. If this option proves to be economical and advantageous the heating system must be redesigned by the site adaption designer to match the available heat source. Where district steam is available and the ammunition surveillance facility is to be heated using a hot water system a steam-to-water converter type heat exchange can be used.

B. COOLING

In the standard design, only the office, break room and tool room of the bay support are air conditioned. If the user wishes to air condition any other areas of the facility it must be justified and approved prior to being designed at site adaption.

1. Site Specific Design Conditions.

The indoor design conditions used for the standard design of the air conditioning system are 78° FDB and 50% relative humidity. No adjustments need to be made to these indoor design conditions at site adaption.

The outdoor design conditions shall be taken from the current edition of the Joint Services Manual, TM 5-785 Engineering Weather Data. An outdoor design condition of 95% FDB, 80° FWB was assumed in designing the air conditoning system for the standard design. If the outdoor design conditions at the selected site are significantly different from the assumed conditions, then the site adaption designer shall recalculate the cooling load and select the appropriate cooling equipment. It may be more efficient and economical to use evaporative cooling in dry climates. If this be the case, drawings must be revised to incorporate the evaporative cooling.

2. Site Specific Configuration Changes

If it is decided to use a different facility configuration from that shown in the standard 6 or 12 bay design, then the designer must recalculate the cooling load and reselect the cooling equipment. All equipment selections must meet the requirements of the specifications for the standard design.

C. VENTILATION

1. Site Specific Design Conditions

The only site specific adjustments to the ventilation system is that standard air correction factors for high altitudes should be applied to all fans including those in the heating and cooling systems, where necessary.

2. Site Specific Configuration Changes

If significant changes in the standard facility configuration are made, then the ventilation system must also change accordingly. The criteria for the ventilation system is given in Appendix A, Design Analysis.

D. PLUMBING

1. Site Specific Changes

a. Where the invert of sewers receiving discharge from the building is less than four feet below the lowest floor, a determination must be made by the user on the need for backwater valves.

b. Selection of piping material for the plumbing system shall be in accordance with TM 5-810-5 based on the water quality classification existing at the site.

c. The plumbing system shown in the 6 and 12 Bay Standard Design is based on a minimum working pressure of 50 pounds per square inch with a 60 gallon per minute flow rate. If water supply conditions other than these exist at the proposed site, it may be possible to redesign the plumbing system within the guidelines of TM 5-810-1 to accommodate the existing water supply.

2. Site Specific Configuration Changes

If a configuration of the facility changes, then the plumbing system must be redesigned within the guidelines of TM 5-810-1 to accommodate those changes.

E. FIRE PROTECTION

1. Site Specific Design Conditions

a. The fire protection system shown in the standard design is a pipe schedule sprinkler system in which pipe sizes are selected from the schedules of pipe sizes given in NFPA Number 13, Section 3.4 for various hazardous class systems. Flow and pressure requirements are estimated from tables 5.1 & 5.2 of TM 5-812-1. The site adaption fire protection designer shall verify the system by hydraulic calculations designing the sprinkler system, selecting pipe sizes and arrangement to match the characteristics of the site specific water supply.

b. The fire protection feed mains and cross mains must be oversized to accommodate the possibility of adding a deluge system in each inspection bay. The standard design has provided a capped TEE in each bay for the deluge system. The additional capacity for each deluge system is estiamted at 0.50 GPM/Ft^2 density, 100Ft^2 area of demand and 15 minute duration at two concurrent locations in any one facility.

2. Site Specific Configuration Changes

If the facility layout changes, then the fire protection must also change to provide complete sprinkler coverage.

VII. ELECTRICAL

A. ELECTRICAL UTILITY INTERFACE REQUIREMENTS

The Standard Ammunition Surveillance Facility (SASF) designs will require revision to suit the electrical utility interface requirements for the specific site. The adequacy of existing electrical lines (near the proposed SASF

site) and associated substations, will require investigation and study by personnel expert in electrical distribution and project electrical utility necessitites, including (but not limited to) electrification availability and reliability features. Appropriately sized electrical distribution line conductors (probably rated 15 kV or 5 kV, must match the site specific distribution voltage) shall be routed to a location approximately 50 feet from the SASF electrical interface conduits (refer to Drawing E-1 for 6-bay and 12-bay designs, and to the respective electrical power plan; Drawing E-3 for 6-bay and Drawing E-4 for 12-bay), for appropriately exhibited determinants.

1. Six (6) Bay Design (refer to 6-bay, Drawing E-1):

a. Provide a 300 kVA pad-mounted transformer complete with primary and secondary surge attenuation (arresters and capacitors) and other requisite accessories. An impedance of not less than 4.5 percent is required for the transformer to limit the available fault circuit to less than the Ampere Interrupting Current (AIC) ratings utilized for the standard equipment shown.

b. Route the transformer secondary feeder conductors in buried conduits. Conduits are to be shown coupled to the motor control center (MCC), MCC-ASF6, incoming feeder conduits shown "stubbed out" on Drawing E-3 for proper interfacing with the site specific design requirements.

c. The 277/480 Volt, 3-phase, 4-wire secondary leads should have an ampacity of not less than 400 Amperes. The designer shall verify the site configured SASF electrical loads and related electrical equipment ratings serving those loads. Two (2) #1/0 A.W.G. copper conductors per phase (75 degree C cable), routed in two conduits (Phases A, B, C, neutral and ground in each conduit), is now perceived adequate.

2. Twelve (12) Bay Design (refer to 12-bay, Drawing E-1):

a. Provide a 500 kVA pad-mounted transformer, complete with primary and secondary surge attenuation (arresters and capacitors) and other requisite accessories. An impedance of not less than 4.5 percent is required for the transformer to limit the available fault current to less than the AIC ratings utilized for the standard equipment shown.

b. Route the transformer secondary feeder conductors in buried conduits. Conduits are to be shown coupled to the motor control center (MCC), MCC-ASF12, incoming feeder conduits shown "stubbed out" on Drawing E-4 for proper interfacing with the site-specific design requirements.

c. The 277/480 Volt, 3-phase, 4-wire secondary leads should have an ampacity of not less than 600 Amperes. The designer shall verify the site configured SASF electrical loads, and related electrical equipment ratings serving those loads. Two (2) #3/0 A.W.G. copper conductors per phase (75 degree C cable), routed in two conduits (Phases A, B, C, neutral and ground in each conduit), is now perceived adequate.

3. Commonalities:

a. Specify and show voltage, current and kWh metering and appropriately-rated, related potential and current transformers in the secondary compartment of the pad-mounted transformer.

b. Specify and show the connection of the pad-mounted transformer secondary neutral conductor to ground in the secondary compartment of the transformer, as well as in the MCC used as service-entrance equipment.

a. Motor Control Center

b. Panelboards

c. Transformers (Dry Type)

d. Inspection Bay Static Grounds

e. Test Cell Static Grounds

f. Storage Cubicle Static Grounds

g. Building Structural Grounds

h. Bonding and Grounding of Electrical Equipment

2. The site-adaption designer shall also show REQUISITE grounding of the following site-specific equipment, connections, and the interconnection with the SASF ground counterpoise.

a. Pad-Mounted Transformer Neutral Ground

b. Bonding and Grounding for Added Electrical Equipment

c. Fence Grounding

d. Rail Access Track Grounds

E. COMMUNICATION SYSTEM INTERFACES

1. Add communication links, including the following features:

a. Telephone

(1 Location of backboard in building

(2) 1" conduit stubbed out 5'-0" from building for future telephone connection.

(3) Surge protection

(4) Refer to letter, US Army Communication Command - DARCOM, CCNC-O-TEL, 10 June 1983, Subject: Review of 35 Percent and 95 Percent Design Package for Ammunition Surveillance Workshop, 6 and 12 Bay Standard Designs, for More Detailed Retalting to Site Adaption Design (See Page 26)

b. Fire Detection and Alarm System

1" conduit stubbed out 5'-0" from building for fire detection and alarm system interface.

Insure compatibility of new system with installations using site fire alary systems.

c. Intrusion Detection System (IDS)

1" conduit stubbed out at 5'-0" for future IDS interface

Insure compatibility of new system with installation's existing IDS.

F. EXTERIOR SECURITY LIGHTING. Security lighting designs shall conform to DOD 5100.76M and FM 19-30.

1. Add exterior lighting to illuminate the SASF security fencing pursuant to the latest site-specific facility necessities.

a. Utilize a spare breaker now shown on panelboard PP-A.

b. Run circuit and conduit to appropriately positioned security lighting electrical hardware.

2. Add an appropriate amount of access road lighting.

3. Add an appropriate amount of lighting to illuminate the security lighting voids between the security fence lighting and the SASF exterior lighting, now shown on the standard drawings.

G. INTERIOR ELECTRICAL SITE SPECIFIC MODIFICATIONS

1. Add electrical requirements for crane equipment if cranes are required by site-specific design criteria. Inspection aisle power outlets for electrical circuits may be used if deemed appropriate by the site-specific designer.

2. Show receptacle mounting heights and locations to suit the equipment and equipment locations.

H. EXTERIOR SITE SPECIFIC CONSIDERATIONS (SPECIAL)

1. Add cathodic protection system if required by the site-specific design criteria.

2. All grounds and grounding systems must be shown interconnected below grade to achieve an equi-potential ground "plane" to minimize the risk of side-flashes or sparking otherwise probable with varying potential differences.

I. STANDARD DESIGN PHILOSOPHY AND REVISIONS

The standard design is provided to show features which are expected to be common to different SASF sitings. The standard design should be followed insofar as practicable, but may be modified as required to suit site-specific approval design criteria different from standard design features shown. Site adapted Designs are subject to the approval of the applicable Design Agency having jurisdiction over construction work at specific sites. US Army Engineer Division, Huntsville should be consulted prior to making significant changes to SASF designs during site-adaption design efforts.

J. CODES AND STANDARDS

1. Nongovernment

a. NEC - National Electrical Code ..... NFPA 70

Lightning Protection Code ..... NFPA 78

b. ANSI - American National Standards Institute

National Electrical Safety Code ..... ANSI C2

c. IEEE - Institute of Electrical and Electronic Engineers

d. NEMA - National Electrical Manufacturers Association

e. NFPA - National Fire Protection Association

f. UL - Underwriter's Laboratories, Inc.

g. ICEA - Insulating Cable Engineers Association

2. Federal Government

a. DOD 4270.1-M - Construction Criteria Manual

b. DOD 5100.76M and FM 19-30 - Security Lighting

c. AR-414-10 - General Provision for Military Construction

d. ER 1110-345-100 - Design Policy for Military Construction

e. ER 1110-345-700 - Design Analysis

f. TM 5-811-1 - Electrical Power Design and Distribution

g. TM 5-811-2 - Electrical Design, Interior Electrical Systems Protection

h. TM 5-811-3 - Electrical Design, Lightning and Static Electricity

i. TM 5-811-4 - Electrical Design, Corrosion Control

j. DARCOM-R 385-100 - DARCOM Safety Manual

k. CE Guide Specifications

DEPARTMENT OF THE ARMY
HQ U. S. ARMY COMMUNICATIONS COMMAND-DARCOM
9001 EISENHOWER AVE, ALEXANDRIA, VA 22333

10 JUN 1982

CCNC-O-TEL

SUBJECT: Review of 35 Percent and 95 Percent Design Package for Ammunition Surveillance Workshop, 6 and 12 Bay Standard Designs

Commander
U.S. Army Engineer Division,
Huntsville
ATTN: HNDED-PM
P. O. Box 1600
Huntsville, AL 35807

1. The following comments are made after reviewing the 35 percent and 95 percent design plans and analysis.

a. Review of plans and design analysis indicates that electrical standards were used as criteria for transmission cables and telephone communication requirements. When considering requirements for communication work, such as transmission termination, grounding, and protection, different methods are used versus the requirements for electrical and power. If design requirements for communication are to be satisfied, the following regulations should be used:

(1) REC Bulletin 345-67, PE-34, REC Specification for Filled Telephone Cables, November 81.

(2) FM 11-486-4, Electrical Communications-Systems Engineering Inside Plant, May 71.

(3) FM 11-486-5, Telecommunications Engineering - Outside Plant, August 82.

(4) FM 11-487-4, Installation Practices; Communications Systems Grounding, Bonding and Shielding, September 78.

b. Statement of Work should set some experience level for contractor who will do communication work. Cable splicer should have at least three years experience on type cable being used for transmission system in support of project.

CCNC-O-TEL
SUBJECT: Review of 35 Percent and 95 Percent Package for Ammunition Surveillance Workshop, 6 and 12 Bay Standard Designs

c. At each site where design package is used, recommend close coordination with the local communication officer/USACC representative at the earliest possible date.

2. Point of Contact for this headquarters is SFC L. Davis, AUTOVON 284-9073.

FOR THE COMMANDER:

ERNEST E. TABER
Colonel, Signal Corps
Commanding

APPENDIX A

FINAL DESIGN ANALYSIS

6 AND 12 BAY

AMMUNITION SURVEILLANCE FACILITIES

STANDARD DESIGNS

APRIL 1983

REVISED AUGUST 1983

APPENDIX A

TABLE OF CONTENTS

VOLUME 1 - Narrative Discussions, Design Assumptions, Philosophy and Reference Sources

VOLUME 2 - Marked-Up Guide Specifications (not included in this Appendix)

SECTION	GUIDE SPECIFICATION NO.	TITLE
	DIVISION 8	
8A	CEGS-08110	Steel Doors and Frames
8B	CEGS-08300	Miscellaneous Doors
8C	CEGS-08700	Hardware; Builders
8D	CEGS-0884	Acrylic Plastic Glazing
	DIVISION 9	
9A	CEGS-09250	Gypsum Wallboard
9B	CEGS-09300	Ceramic Tile
9C	CEGS-09431	Conductive Sparkproof Industrial Resinous Flooring
9D	CEGS-09910	Painting; General
	DIVISION 10	
10A	CEGS-10160	Metal Toilet Partitions
10B	CEGS-10800	Toilet Accessories
	DIVISION 11	(NOT USED)
	DIVISION 12	(NOT USED)
	DIVISION 13	(NOT USED)
	DIVISION 14	(NOT USED)
	DIVISION 15	
	CEGS-15250	Thermal Insulation for Mechanical Systems
15B	CEGS-15400	Plumbing; General Purpose
15C	CEGS-15501	Sprinkler Systems, Fire Protection
	CEGS-15703	Hot Water Heating System: Oil, Gas or Combination Oil/Gas Fired
15E	CE-301.08	Ventilating System, Mecahnical
15F	CE-301.35	Air-Conditioning System (Unitary Type)

SECTION	GUIDE SPECIFICATION NO.	TITLE
	DIVISION 16	
16A	CE-303.01	Electrical Work, Interior
16B	CEGS-16721	Fire Detection and Alarm System
16C	CEGS-16750	Intrusion Detection Equipment

I. GENERAL

1. Introduction:

1.1 Tasking:

Huntsville Division has been tasked by the Office of the Chief of Engineers to develop two (2) OCE standard plans for Ammunition Surveillance Workshops. One standard plan is to be for a 6 bay workshop and the other for a 12 bay workshop. The only differences between the 6 bay and 12 bay are the number of work bays and the number of people who will occupy the facilities during normal duty hours. As a result, the designs are very similar and will use the same design details with few exceptions. The design analysis has been consolidated so as not to be repetitious. Both the 6 bay and 12 bay design analyses have been combined; where there are differences, they are so noted.

1.2 Applicable Restrictions

The Ammunition Surveillance Facilities are facilities falling under the purview of AR 385-60 and AR 385-64. These regulations address the special review requirements and safety distances applicable to explosive-handling facilities. They should be consulted prior to programming of site adaption design.

II. ARCHITECTURAL DESIGN ANALYSIS

1. General:

1.1 The Ammunition Surveillance Workshop is a single story, non-combustible structure. The facility houses inspection bays, test cubicles, storage cubicles and support functions.

1.2 The exterior wall is constructed of prefinished insulated metal sandwich panels at the inspection bays and precast concrete panels at the support area. The roof construction is prefinished insulated metal sandwich panels

with standing seams and concealed fasteners for the inspection bays and precast concrete panels with metal panel covering at the support area.

2. Building Construction Analysis:

Storage cubicles are to be constructed in accordance with the requirements of paragraph 3-3, AR 190-11 and Chapters 4 and 5, DOD 5100.76M, Physical Security of Sensitive Conventional Arms, Ammunition and Explosives, March 1982.

Ceiling finish in all areas will be exposed construction.

Floor finish will be ceramic tile in the toilets. Floors will be stained and sealed in the bay support area, tool room, supply room, cafeteria and corridor. The inspection bays, test cubicles, storage cubicles and adjacent areas will receive sparkproof, non-porous conductive flooring.

III. STRUCTURAL DESIGN ANALYSIS

1. General:

The general structural design philosophy for this project involves the use of practical building elements into the structural system of the facility in an effort to minimize cost and maximize building efficiency. Repetitive structural details and standardized member connections are repeated as much as possible.

The building is evaluated on its own geometrical, functional, and aesthetic terms. The majority of the building is designed for rigid frame action.

The single-story building is divided into three areas according to its function.

Inspection Bay Area

The dividing walls are designed as per TM 5-1300 to provide

Category 3 protection due to a 425 pound charge weight in an adjacent bay. In case of an accidental explosion in one of the inspection bays, the insulated metal panel roof and sidewalls are sufficiently frangible to provide adequate venting of the blast pressure. The roof framing is composed of steel joists spanning between dividing wall.

Storage Bay Area

Storage cubicles are designed to be constructed to provide protection equivalent to the structural standards of DOD 5100.76M for security risk Category II material. Walls separating a storage cubicle from another storage cubicle or from an inspection bay or loading area also will be constructed to afford Category 3 protection in accordance with TM 5-1300 for 425 lb. NEW of explosives.

1.3 Support Area

This area is designed as a precast, reinforced concrete panel or cast-in place reinforced concrete for walls and roof. The end walls separating the operational bay from the support area, roof, and perimeter walls are designed to provide TM 5-1300 Category 1 protection; that is, the building can be considered a "shelter" for the designated blast load.

Miscellaneous

The test cubicle is a cast-in-place reinforced concrete structure that is designed to provide TM 5-1300 Category 1 protection for 15 pounds of HE. A vent is provided to vent hot exhaust gases in case of accidental rocket motor igni tion during the continuity test.

2. DESIGN CRITERIA

Conventional Design (Nonblast-Resistant):

2.1.1 Material Strengths

2.1.1.1	Structural Steel ASTM A-36	Fy = 36 ksi
2.1.1.2	Concrete	
	Precast concrete	f'c = 5000 psi
	Blast walls and foundations	f'c = 4000 psi
	Cast-in-place slabs-on-grade, non-blast wall foundations	f'c= 3000 psi
2.1.1.3	Reinforcement	fy = 60,000 psi
	Lacing, ties	fy = 40,000 psi
2.1.2	Loading Assumptions	
2.1.2.1	Roof live load	w = 30 psf
2.1.2.2	Wind load (Exposure C, Category III) (IAW ANSI 58.1)	V = 90 mph
2.1.2.3	Floor live loads	w = 125 psf
	Forklift load	6000 lbs capacity
2.1.2.4	Mechanical, electrical & miscellaneous (floor and roof load)	15 psf
2.1.2.5	Seismic design	Zone 4
		.14
		I = 1.0
		Z = 1.00
		k = 1.00
2.1.3	Soil Design Data	
2.1.3.1	Allowable soil bearing	2000 psf
2.1.3.2	Cantilever Blast Walls Foundations	
	Soil Parameters:	

a. Sands and non plastic silts

0 = 31.5°; fc = 0.58; E = 3000 psi; u = 0.275

0 = 34°; fc = 0.675; E = 5500 psi; u = 0.25

b. Clays, sandy-clay mixtures, plastic silts

Adhesion, c = 750 psf; E = 3500 psi; u = 0.45

Adhesion, c = 1500 psf; E = 5500 psi; u = 0.45

c. The foundations have been designed for the above soil parameter ranges and soil bearing pressure.

2.1.4 Design Method

2.1.4.1 Structural steel - In accordance with Specification for the Design, Fabrication, and Erection of Structural Steel for Building, 1978.

2.1.4.2 Reinforced concrete - In accordance with ACI 318-77.

2.2 Blast-Resistant Design

2.2.1 The design criteria for conventional design also apply to blast-resistant design except that the concrete for the blast walls shall develop a compressive strength, f'c, of 4000 psi.

2.2.2 Concrete:

2.2.2.1 Modify design yield strength of concrete and reinforcement according to the procedures of Chapter 5, TM 5-1300, for the applicable design range and allowable support rotation.

2.2.2.2 Reusable elements, including those indicated for TM 5-1300 Category 1 protection, are designed for support rotations between 0 degrees and 2 degrees, as illustrated on page 6-2 of TM 5-1300. This design is also referred to as "limited deflections.

2.2.2.3 Elements indicated TM 5-1300 for Category 3 protection are

designed for support rotations between 5 degrees and 12 degrees up to incipient failure.

2.2.3 Design Methods:

2.2.3.1 The methods noted for use in conventional design are also used for the blast design, modified in accordance with CE criteria and applicable technical references.

2.2.3.2 List of References (Partial):

2.2.3.2.1 TM 5-1300 - Structures to Resist the Effects of Accidental Explosions.

2.2.3.2.2 TR 4837 - Design of Steel Structures to Resist the Effects of HE Explosions.

2.2.3.2.3 TR 4921 - Overturning and Sliding Analysis of Reinforced Concrete Protective Structures.

2.2.3.2.4 ASCE No. 42 - Design of Structures to Resist Nuclear Weapons Effects.

2.2.3.2.5 TR R-828 - Blast Environment from Fully and Partially Vented Explosions in Cubicles.

2.2.4 Automated Design/Analysis

2.2.4.1 CBARCS Program for nonlinear dynamic design of reinforced concrete slabs under blast loading.

2.2.4.2 BLASST Program for overturning and sliding analysis of reinforced concrete protective structures.

2.2.4.3 PICATIN Program for computing impulse loads.

IV. MECHANICAL DESIGN ANALYSIS

1. Heating: The standard design of the Ammunition Surveillance Facility heating system is based upon an outside design temperature of 0°F DB. If the

site specific outside design conditions are significantly different from the standard design temperature, the site adaption designer shall recalculate the required heating capacity and select the appropriate heating equipment. Site specific outside design temperatures shall be based upon weather data taken from the current edition of Joint Services Manual, TM 5-785 Engineering Weather Data.

Inside design temperatures are in accordance with DoD 4270.1M and AR 11-27 and are as follows:

Bay Support Area -	65°F DB
Inspection Bays	55°F DB
Mech Equip Rm	50°F DB
Supply Room	55°F DB

The heating system for the standard design is a low temperature forced hot water system using a low pressure packaged boiler, hot water distribution piping, unit heaters and a heating coil in the bay support area air handling unit. The boiler will be oil or gas fired determined by the user based on fuel availability. The fuel storage tank shall be located by the user in accordance with NFPA No. 30 and DARCOMR385-100. The boiler will be equipped with automatic controls and firing systems and safety devices to the maximum extent to permit unattended operation.

Interior temperatures shall be controlled by a master outdoor temperature sensing unit which modulates the hot water temperature in accordance with outdoor temperature with positive cutoff above 60°F. An automatic temperature setback is available for nights and weekends. Motor and other electrical devices in the inspection bay area are hazard classifications Class I, Div. 1, Group C & D and Class II, Div. 1, Group E, F & G and of sparkproof construction.

2. Air Conditioning: The standard design of the Ammunition Surveillance Facility Bay Support Area air conditioning system is based upon outside design conditions of95°F DB, 80° FWB. If the site specific outside design conditions are significantly different from the standard design temperature, the site adaption designer shall recalculate the required air conditioning capacity and reselect the appropriate equipment. Site specific outside design conditions shall be based on weather data taken from the current edition of Joint Services Manual, TM 5-785 Engineering Weather Data.

Inside design conditions for the standard design are 78°F db and 50% relative humidity. Air conditioning is provided in the office area, lunch room and tool room of the bay support area only. The inspection bay area and the other rooms in the bay support area are not to be air conditioned in the standard design. Additional air conditioning will have to be justified and approved on a site specific basis.

The air conditioning system is a split system air conditioner consisting of a remote roof-mounted air cooled condensing unit and a matched evaporator blower unit located below the roof in the tool room. The condensing unit shall be a complete packaged, factory assembled, electrically operated unit consisting of a compressor, air cooled condenser, circulating fan and motor and the necessary structural frame, housing, valves, piping, wiring and controls. The evaporator blower unit shall include a cooling coil, expansion device, hot water heating coil, blower, motor and controls, air filters, condensate pan and drain. Temperature controls shall be electric, or electronic, solid-state electronic, or pneumatic type, or a combination thereof that will provide the required sequence of operation control.

3. Ventilation: Ventilation of the Ammunition Surveillance Facility conforms to the requirements of DoD 4270.1-M and Mechanical Design Manual TM 5-810-1.

Ventilation of the inspection bay area is provided to limit inside temperatures to a maximum of 10°F above the outside summer design temperature. An outside summer design temperature of 95°F DB is used for the standard design. Ventilation of the inspection bay area is accomplished by eight wall mounted propeller fans with gravity dampers. Each fan is interlocked with a motorized air intake louver/damper located across the room from each fan. The fan is thermostat controlled with a manual override switch. Motors and other electrical devices in the inspection bay area are hazard classification Class I, Div. 1, Groups C & D and Class II, Div. 1, Groups E, F & G and of sparkproof construction.

Wall mounted exhaust fans are used in the 6 bay facility to ventilate the bathrooms at ten air changes per hour. Roof mounted exhaust fans are used in the 12 bay facility. Make up air is provided through louvered doors. The fans are controlled such that they are on when the bathroom lights are on.

The 6 bay facility has a wall mounted 2-speed exhaust fan to provide 20 airchanges per hour (summer) and 10 airchanges per hour (winter) in the mechanical equipment room. The 12 bay facility uses a roof mounted fan to provide the same airchanges. Make up air is provided by weatherproof louvers in the outside doors of the mechanical equipment room. This fan is thermostatically controlled with a manual override switch.

A roof mounted exhaust fan is provided in the lunchroom for ventilating when required by heavy smoking during high occupancy periods. This fan has a manual control switch for use when needed.

4. Plumbing: The plumbing design conforms to the requirements of TM 5-810-5, the National Plumbing Code and DoD 4270.1-M.

The plumbing system design shown in the standard design is based upon minimum working pressure of 50 PSI at a flow rate of 60 gpm at the location where the main service enters the building. The site adaption designer must verify the plumbing system design based upon available water quality, flow rate and pressure for the selected site. An electric water heater provides 60 gph with a storage capacity of 66 gallons. One eyewash/safety shower station is provided for each three inspection bays at an accessible location.

Compressed air is provided by a receiver mounted, air cooled, packaged electric compressor. The capacity for the 6 bay facility is 75 CFM free air at 100 PSI actual delivery with a 120 gallon air receiver. The 12 bay facility has two such compressors to provide a total of 150 CFM at 100 PSI actual delivery. The compressor has an automatic start-stop control. The compressed air distribution system provides two air outlets for each work bay, and one air outlet in the tool room.

5. Fire Protection: The fire protection system shall conform to TM 5-812-1, DoD 4270.1-M, NFPA and DARCOMR 385-100. The entire facility is protected with an overhead wet-pipe sprinkler system using water supplied by the user.

Fire protection requirement for the bay support area is Light Hazard Occupancy as defined in TM 5-812-1. This occupancy classification requires a 0.10 gpm/sq. ft. sprinkler coverage.

The inspection bay area fire protection requirement is defined as Ordinary Hazard Group 3 requiring 0.25 gpm/sq. ft. sprinkler coverage. Ordinary Hazard Group 3 classification is chosen rather than Extra Hazard occupancy since

exposed explosive is not normally indigenous to the operation. In those inspection bays where exposed powder operations are being conducted a deluge system will be provided by the user to accommodate the extra hazard. The standard design provides a 3 inch capped water supply in each bay for connection of the deluge system.

V. ELECTRICAL DESIGN ANALYSIS

1. Reference Documents:

1.1 National Electrical Code.....NFPA 70

Lightning Protection Code.....NFPA 78

National Electric Safety Code.....ANSI - C2

1.4 DARCOM Safety Manual.....DARCOM-R 385-100

2. General:

The standard electrical designs are adaptable to modular requirements of different sites. The standard electrical design includes the following characteristics or features:

2.1 Electrical Load:

For each 6 Bay facility (building not exceeding 20,000 square feet), the electrical demand load is estimated to be in the order of magnitude of 250 kW. An average demand not exceding 12.5 watts per square foot. Assumption of an .8 power factor indicates a maximum demand load of approximately 300 kVA for the 6 Bay facility. The electrical demand for the facility will vary over a wide range, depending upon the activity of the individual installation, as well as the future year installation of test and surveillance equipment. Accordingly, a pad-mounted transformer installation sized at 300 kVA for the 6 Bay facility and 500 kVA for the 12 Bay facility should be sufficient.

However, inasmuch as the transformer will be external to the structure the related decision of transformer size, for specific installations, will be part of the future site specific design effort and calculations. The transformer impedance shall be no less than 4.5%.

2.2 Electrical Service:

The electrical design includes a Motor Control Center (MCC), rated 480/277-Volt, three phase, four wire, plus ground bus, 600 Ampere main bus with an adequate ampere interrupting rating consistent with the available short circuit current (i.e., 22,000 amperes symmetrical maximum at MCC Bus). The MCC main circuit breaker has a 600 Ampere frame, 400 Ampere trip rating, when supplied from a 300 kVA transformer installation; and 600/600 Ampere trip rating when supplied from a 500 kVA transformer configuration. In any event, the MCC shall be supplied from the site configured transformer installation with the MCC main breaker trip setting coordinated with the appropriate site ampacity. The MCC shall, in turn, supply the facility loads including the following:

2.2.1 Transformers:

Two (2) dry-type transformers, each rated 75 kVA, 480 Volts, three phase primary, with a secondary rating of 120/208 Volts, three phase, four wire, 60 Hertz. Each 75 kVA transformer shall supply a 225 Ampere panelboard. The panelboards shall be the INTERFACE for future site specific load circuits. A 30 kVA dry type transformer shall serve the bay support area 120 volt loads. See Drawing No. E-1.

2.2.2 HVAC:

Building HVAC loads, shown on the standard designs drawings, as modified by the site specific future effort.

2.2.3 Mechanical Loads:

A building process and other electrically power mechanical loads, shown on the standard design drawings, as modified by the site specific future effort.

2.2.4 Distribution Panelboard:

A building contained 480/277-Volt distribution panelboard serves as the INTERFACE for 480/277-Volt loads that evolve in the site configuration effort of facilities. Conduit sleeves through blast walls are configured with appropriate conduit seal fittings and respective interface pull boxes.

2.3 Lightning Protection:

LIGHTNING PROTECTION SHALL BE IN ACCORDANCE WITH THE LIGHTNING PROTECTION CODE (1980), NFPA 78, chapter 6 and be implemented by the site adaption designer. Protective, overhead ground conductors shall be configured pursuant to figures 6-3.3.1. and 6-3.3.2. of the CODE, with the associated conductor supporting MASTS positioned OUTSIDE the Standard Design Building Limit. Mast locations shall not be less than 10 feet from building wall or building extensions (canopy or overhanging structures) to preclude LIGHTNING DAMAGE from "Side Flashes" to building conductors. The overhead shield conductors shall be brought down the MAST(s) and directly connected to the grounding counterpoise system in no less than two (2) locations each mast. Further, the site adaption designer shall refer to and include the LIGHTNING PROTECTION applicable portions of AMCR 385-100 and the NATIONAL ELECTRICAL CODE.

2.4 Lighting:

Lighting circuits shall be 120-Volt to comply with voltage drop and switching requirements.

Lighting levels are as follows:

2.4.1 Typical Inspection Bay: 50 fc (max)

Switching at 17, 34 and 50 fc levels is provided within each work bay. Explosion proof fluorescent fixtures and lamps are used.

2.4.2 Typical Bay Access Aisle: 10 fc (max)

Switching at 3, 7 and 10 fc levels is provided at the aisles. Night lighting is provided at the 3 fc level.

2.4.3 Bay Support Office: 54 fc

Switching at 27 and 54 fc is provided. Night lighting at the 3 fc level is provided.

2.4.4 Break Room: 30/36 FC

Night lighting at the 6.5 fc level is provided.

2.4.5 Tool Storage Room: 30/35 fc

Night lighting at the 3 fc level is provided

2.4.6 Bay Support Area Corridor: 5 Luminaires

2.4.7 Supply Room: 30 fc

Night lighting at the 5 fc level is provided

Fire Detection and alarm System:

Fire Detection and Alarm System (FDAS) shall be part of the standard design, with FDAS central reporting features implemented later, that is at the time the standard design site adapted. The Fire Detection and alarm System shall be compatible with the existing site fire alarm system and comply with NFPA 72.

The Ultraviolet Detectors (UV) shall not be provided in the standard design but spare conduits be installed for future work.

Standby Power:

No back-up power supply or UPS system requirement has been included in the standard electrical design.

Safety:

Safety considerations require that specific portions of the electrical design incorporate hazardous rated equipment and design features. All work bays shall be classified hazardous areas:

Class I, Div 1, Groups C and D and

Class II, Div 1, Groups E, F, and G

The bay support area shall be rated as non-hazardous. Further, conductive floors will be provided and provisions for static grounding of equipment will be included for each work bay.

Emergency Lighting:

Emergency and exit lighting is provided, using appropriate battery operated lighting fixtures, supplied by normal power supplies. Battery and associated 24 Volt D.C. console system is located in a non-hazardous area.

Future Consideration:

The electrical load of "future" power conveyors shall be assumed not to exceed 30 horsepower, at 480 Volts, three phase, 60 Hertz, pending determination of actual requirements. Significant power conveyor electrical loads shall directly increase the facility transformer sizing.

Security System:

The security system shall comply with AR 190-11 and be compatible with the existing site security system. The security system provides security for the storage cubicles consisting of balanced magnetic switches for the doors for entrance into and exit from the storage cubicles.

Communications:

A 1" spare conduit is provided for telephone service.